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RA-18-0240

December 18, 2018 10 CFR 50.73

Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2746

Duke Energy Carolinas, LLC
Oconee Nuclear Station Unit 1
Docket Numbers: 50-269
Renewed Operating Licenses: DPR-38

Subject: Licensee Event Report 269/2018-002, Revision 00 – Loss of Condenser Vacuum Results in a Main Turbine Trip and a Manual Reactor Trip

Licensee Event Report 269/2018-002, Revision 00, is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

There are no regulatory commitments associated with this LER.

If there are questions, or further information is needed, contact Samuel L. Adams, Senior Licensing Engineer, Regulatory Affairs, at (864) 873-3348.

Sincerely,

Carrie T. Dunton
Director, Nuclear Site Support
Oconee Nuclear Station

Enclosure

IE22
NRR

cc (w/Enclosure):

Ms. Catherine Haney, Administrator, Region II
U.S. Nuclear Regulatory Commission
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Ms. Audrey L. Klett, Project Manager
(by electronic mail only)
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Mr. Eddy Crowe
NRC Senior Resident Inspector
Oconee Nuclear Station

NRC FORM 366 (04-2018) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name	2. Docket Number	3. Page
Oconee Nuclear Station Unit 1	05000269	1 OF 5

4. Title

Loss of Condenser Vacuum Results in a Main Turbine Trip and a Manual Reactor Trip

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
									N/A	05000
10	19	2018	2018	002	00	12	18	2018	Facility Name N/A	Docket Number 05000

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. Power Level	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
25%	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(ii)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(iii)
		☐ 50.73(a)(2)(i)(C)	☐ Other (Specify in Abstract below or in NRC Form 366A	

12. Licensee Contact for this LER

Licensee Contact	Telephone Number (Include Area Code)
Samuel L. Adams, Senior Licensing Engineer, Oconee Regulatory Affairs	(864) 873-3348

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable To ICES	Cause	System	Component	Manufacturer	Reportable To ICES
E	AS	Fisher 3582	F052	Y					

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
☐ Yes (If yes, complete 15. Expected Submission Date) ☒ No				

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

On October 19, 2018, Oconee Unit 1 was in the process of shutting down to begin a scheduled refueling outage when auxiliary steam control valve 1AS-10 failed to open. At the time this occurred Unit 1 was at approximately 19% Rated Thermal Power (RTP) with the turbine-generator online. The failure of 1AS-10 caused a loss of Steam Seal Header (SSH) pressure which resulted in a decrease in condenser vacuum and a subsequent automatic turbine trip. Operators anticipated a loss of the operating Main Feedwater (MFW) pump and manually started both Motor Driven Emergency Feedwater (EFW) pumps (MDEFWPs). The cooler EFW flow entering both steam generators led to a 5.8% increase in reactor power. Operators manually tripped the reactor at approximately 25% RTP based on approaching the automatic trip of the last MFW pump at 19" Hg condenser vacuum which would have resulted in an automatic reactor trip.

The event was reported on October 19, 2018, via NRC Event Number 53677. This Licensee Event Report (LER) is required pursuant to 10 CFR 50.73(a)(2)(iv)(A) as a valid actuation of the Reactor Protection System (RPS) and EFW.

1AS-10 failed to open because of age-related degradation of the positioner relay. It was determined that the Preventive Maintenance (PM) scope was inadequate. The positioner relay was replaced to correct the failure.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Oconee Nuclear Station Unit 1	05000-269	2018	002	00

NARRATIVE

EVALUATION:

BACKGROUND

The purpose of the main turbine [EIIS: TA] and feed pump turbine [EIIS: TRB] steam seal header is to provide sealing steam to the turbine end seals so that air cannot be drawn into the turbine and steam cannot escape to the atmosphere. At 19% RTP, the turbine seals are normally supplied from the auxiliary steam system [EIIS: SA], but can also be supplied from the main steam system upstream of the main stop valves. The steam-seal system [EIIS: TC] provides this function automatically from startup to full load and makes it possible to establish full vacuum in the condenser [EIIS: SG] while the turbine-generator is being rotated by the turning gear.

Valve 1AS-10 is the steam seal regulating valve that controls pressure to the high-pressure turbine steam seal header. 1AS-10 is an air to close, spring to open Fisher model 657-AA actuator and valve. 1AS-10 is controlled by a Fisher model 3582 positioner. The supply air and signal air are connected to the positioner with an internal pneumatic relay [EIIS: RLY] acting as the distribution point for increasing and decreasing output pressure to the actuator depending on the input signal. The 1AS-10 positioner accepts 3 psig to 15 psig input signals from pressure transmitter (1SSH-PT-248) [EIIS: PT] and sends an increasing or decreasing output pressure to the actuator to control the valve position.

EVENT DESCRIPTION

On the evening of October 19, 2018, operators were in the process of taking Oconee Unit 1 (ONS-1) offline for a scheduled refueling outage. At the time, ONS-1 was at approximately 19% RTP with the turbine-generator online producing approximately 32 MWe. At some point prior to the event, Auxiliary Steam (AS) System control valve 1AS-10 failed to open on demand. 1AS-10 supplies steam to the Unit 1 Main Turbine steam seals below approximately 25% RTP. At approximately 2039 during conduct of the turbine-generator down power activity, the Steam Seal Header (SSH) pressure began to slowly decrease.

At 2147 operators received a LOW VACUUM alarm for Main Condenser vacuum at 25" Hg and lowering. Operators then entered the applicable Abnormal Procedure (AP).

The AP instructs operators to trip the reactor at 22" Hg condenser vacuum. At this point in the event the reactor was at 19% RTP and stable.

Operators calculated, based on the current lowering vacuum trend, that there were approximately 36 minutes until the 22" Hg trip threshold was reached and continued with shutting down the unit. It was later determined that unloading the turbine as part of the unit shutdown had reduced the time it would take to reach this threshold to about 8 minutes, because unloading the turbine reduces the turbine self-sealing capability.

At 2156, upon reaching 21.75" Hg main condenser vacuum, the turbine tripped automatically.

During the event operators questioned whether the AP requirement to trip the reactor at 22" Hg was appropriate since reactor power was less than 27.75% RTP, and that at 19" Hg, the main feed pumps would trip automatically, which would automatically trip the reactor. Actions were being taken to mitigate the loss of condenser vacuum, and operators reasoned that if vacuum was restored, then a controlled reactor shutdown could be performed with normal operating procedures. As a result, at 2158 operators invoked a procedure variance to not trip the reactor to avoid an unnecessary transient, and established a new reactor trip threshold of 19.5" Hg based on automatic actions anticipated to occur at 19.0" Hg.

At 2200 operators, anticipating a loss of the operating main feedwater (MFW) pump, manually started both MDEFW pumps. This action resulted in cooler EFW entering the SGs and reactor power increased to approximately 25% RTP within approximately 2 minutes. At 2202 the reactor was manually tripped in anticipation of an automatic trip of main feedwater pumps due to degraded condenser vacuum. The manual reactor trip terminated the reactor power increase.

Concurrent with these events, vacuum was stabilized at approximately 19.25" Hg using the Loss of Main Condenser Vacuum AP. Shortly after the reactor was tripped operators secured both MDEFWPs with SG feedwater being supplied by the MFW pump. Due to the recovery of main condenser vacuum, the MFW Pump did not receive a trip signal and no MDEFW auto start or automatic reactor trip signals were generated.

The plant response for this event was as expected given the operator actions and normal plant automatic responses. The reactivity excursion resulting in a peak reactor power of approximately 25% RTP did not challenge any core thermal margins due to the relatively low power levels involved during the event. No adverse plant responses were observed. No structures, components, or systems were inoperable at the start of the event that contributed to this event.

ONS Units 2 and 3 were operating in MODE 1 at approximately 100% RTP and were not affected.

Reportability

This event was reported as a 4-hour notification to the NRC on October 19, 2018, in Event Notification (EN) number 53677 under 10 CFR 50.72(b)(2)(iv)(B) - Reactor Protection System (RPS) Actuation - Critical. The event is also reportable under 10 CFR 50.72(b)(3)(iv)(A) as an actuation of the Emergency Feedwater (EFW) System.

CAUSAL FACTORS

The cause of the manual reactor trip was the failure of Auxiliary Steam (AS) System valve 1AS-10 that resulted in a loss of steam seal header pressure and subsequent main condenser vacuum decrease while continuing to offload the turbine for the refueling outage.

The cause of the manual initiation of EFW is attributed to failure to recognize and correct performance weaknesses in Control Room leadership oversight and Operations team effectiveness.

CORRECTIVE ACTIONS

Completed:

Inspection of the 1AS-10 positioner was performed and identified that the internal relay was not allowing the actuator diaphragm pressure to bleed off. The relay was replaced, the positioner calibration was verified and the valve returned to service prior to Unit 1 start up from the refueling outage.

Completed actions to correct human performance weaknesses include face-to-face meetings and a simulator segment with Oconee Licensed operators, emphasizing conservative decision-making and leadership behaviors.

Planned:

Based on an extent of condition review, actions are in place to ensure appropriate actuator PMs include positioner replacement for all three ONS Units.

An evaluation is in progress to investigate human performance during the event. Duke Energy plans to implement recommendations from this evaluation to address the human performance deficiencies.

SAFETY ANALYSIS

The ONS-1 manual trip on October 19, 2018, had no impact on public health and safety. The failure of valve 1AS-10 and loss of SSH pressure that led to the manual trip did not affect the post-trip response of the feedwater and condensate systems. The unplanned power increase caused by the manual initiation of the MDEFW pumps was small and did not challenge any core thermal limits. The post-trip response was uncomplicated and main feedwater flow to the steam generators was maintained throughout the event. No Emergency Core Cooling System (ECCS) or other automatic safety system actuations occurred in response to this event and no other equipment problems were experienced that required unusual operator actions. Thus, it is concluded that this event had no impact on public health and safety.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
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ADDITIONAL INFORMATION

A review of Duke Energy's Corrective Action Program did not identify any similar Oconee LERs or events in the last 3 years involving the same conditions or cause of this event.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX]. This event is considered INPO Consolidated Events System (ICES) Reportable. There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.